

# ACTUATING MECHANISM FOR A MOVABLE ARM OF A PIPE BENDER

## BACKGROUND OF THE INVENTION

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### 1. Field of the invention

The present invention relates to an actuating mechanism for a movable arm of a pipe bender, more particularly one, which occupies less space while sufficient torque provided by the actuating mechanism is maintained.

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### 2. Brief Description of the Prior Art

Referring to Fig. 3, a conventional pipe bender 4 includes a main support 41, a holding portion 42 above the main support 41 at a front end, a shaft 43 arranged in the front holding portion 42, a movable arm 44, a stationary arm 45, and an actuating mechanism, which includes a transmission 46, and a hydraulic cylinder 461. The movable arm 44 is connected to the shaft 43 while the stationary arm 45 is fixed to the front holding portion 42. Both of the arms 44 and 45 have clipping elements fitted thereto; clipping elements are not the subject of the invention therefore they will not be shown or detailed herein. The transmission 46 is comprised of a first chain wheel 464 connected to the shaft 43, a second chain wheel 465 arranged in a rear portion of the pipe bender, a first chain 462, a second chain 463, and a connecting rod 466; the first

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chain 462 and the second chain 463 are connected to two ends of an output rod of the hydraulic cylinder 461 at first ends, and connected to the connecting rod 466 at second ends, and are passed over, and engaged with the first and the second chain wheels 464, 465; thus, the movable  
5 arm 44 can be displaced relative to the stationary arm 45 when the hydraulic cylinder 461 functions. Therefore, a pipe can be bent by means of the pipe bender 4 after it is clipped onto the arms 44 and 45 by the clipping elements.

Furthermore, the pipe bender can also function in case a spur gear  
10 is connected to the shaft 43 instead of the first chain wheel 464 while a rack is connected to the output rod of the hydraulic cylinder 461, and engaged with the spur gear.

However, the shaft 43, the chain wheels, and the hydraulic cylinder will increase the weight and dimensions of the pipe bender significantly  
15 because they are made relatively large so that the movable arm 44 can be angularly displaced relative to the stationary arm 45 with enough torque to bend a pipe effectively and efficiently. Consequently, the above-mentioned parts cause a lot of extra cost, and the pipe bender is less competitive, and not economical to use.

20 To overcome the above disadvantage, referring to Figs. 4, and 5, another pipe bender is equipped with a planetary gear set 5 in a front end holding portion 42 thereof, and a power source 51 hung under a bottom board support 421 of the front end holding portion 42, which planetary

gear set 5 is a gear reduction mechanism for delivering great torque output. A gear 512 is secured to an output shaft (not numbered) of the power source 51, and connected to a transmitting element 511 while a gear 422 is arranged under the board support 42 to engage the transmitting element 511. The planetary gear set 5 is comprised of a fixed sun gear 55, a central shaft 52 arranged in the sun gear 55 and securely connected with the gear 422 at a lower end, several planet pinions 53, and an actuating shaft 54, which is connected to a movable arm of the pipe bender, and arranged in the sun gear 55. The sun gear 55 has gear teeth on an inner side thereof. The planet pinions 53 are rotary on respective shafts 531 supported in position on the actuating shaft 54, and are engaged with both the central shaft 52 and the toothed inner side of the sun gear 55; thus, when the central shaft 52 and the gear 422 are made to turn by the power source 51, the planet pinions 53 will rotate on respective shafts 531, and make circular motion around the central shaft 52. Therefore, when the power source 51 functions, the actuating shaft 54 is turned owing to the circular motion of the planet pinions 53, and the movable arm is angularly displaced relative to a stationary arm to bend a pipe, which has been clipped onto both of the arms by means of clipping elements (not shown).

The pipe bender has the planetary gear set 5 as transmission that has smaller weight and dimensions than the shaft 43, the chain wheels, and the hydraulic cylinder 461 therefore it is more economical to use

than the first conventional one. However, because the power source 51, which is relatively large in size, occupies the space under the front end holding portion 42 of the pipe bender, it will make the pipe bender inconvenient to use, and there is room for improvement. Furthermore, 5 the transmitting element 511 is a resilient apparatus, e.g. gear belt, belt, and chain, and needs position adjustment after certain length of time of use therefore it is not convenient to use.

## SUMMARY OF THE INVENTION

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It is a main object of the present invention to provide an actuating mechanism for a movable arm of a pipe bender to overcome the above disadvantages.

The actuating mechanism includes a power source for delivering 15 torque for displacing the movable arm with, and a transmission for passing on movement of the power source to the movable arm; the transmission includes a planetary gear set, a crown gear securely connected with a lower end of a central shaft of the gear set, and an actuating pinion; the movable arm is connected with an actuating shaft of 20 the gear set so that it can be angularly displaced when the planetary gear set is actuated by the power source. The actuating pinion is securely connected with an output shaft of the power source, and directly engaged with the crown gear for passing on movement of the power source to the planetary gear set instead of conventional chains and chain wheels. The

power source is hidden in a holding portion of the pipe bender to not stick out to occupy extra space under the pipe bender.

## BRIEF DESCRIPTION OF THE DRAWINGS

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This invention will be better understood by referring to the accompanying drawings, wherein:

Fig. 1 is a vertical section of the actuating mechanism for a movable  
10 arm of a pipe bender according to the present invention,

Fig. 2 is a top view of the actuating mechanism for a movable arm of a pipe bender according to the present invention,

Fig. 3 is a partial top view of the first conventional pipe bender as described in the Background,

15 Fig. 4 is a partial top view of the first conventional pipe bender, in operation,

Fig. 5 is a side view of a second conventional actuating mechanism of a pipe bender, and

20 Fig. 6 is a vertical section of the second conventional actuating mechanism.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to Figs. 1, and 2, a preferred embodiment of an actuating mechanism for a movable arm of a pipe bender in the present invention includes a crown gear 1, an actuating pinion 2, a power source 3, and a planetary gear set 5, all arranged in a holding portion 42 of the pipe bender.

The power source 3 is comprised of a planetary gear set 32, and a motor 322 arranged behind the planetary gear set 32. The planetary gear set 32 includes a central shaft 321 connected to an actuating shaft 3221 of the motor 322, a fixed sun gear 324 arranged around the central shaft 321, and several planet pinions 323. An output shaft 31 is arranged in the sun gear 324. The sun gear 324 has gear teeth on an inner side thereof. The planet pinions 323 are rotary on respective shafts 3231 supported in position on the output shaft 31, and are engaged with both the central shaft 3221 and the toothed inner side of the sun gear 324. In addition, the actuating pinion 2 is securely connected to a front end of the output shaft 31. Thus, the planet pinions 323 will rotate on respective shafts 3231, and make circular motion around the central shaft 321 when the central shaft 3221 is made to turn by the motor 322. Therefore, the output shaft 31 as well as the actuating pinion 2 will be turned with the circular motion of the planet pinions 323 when the motor 322 functions.

The planetary gear set 5 is a gear reduction mechanism for

delivering great torque output, and is arranged in front of the power source 3. The planetary gear set 5 includes a fixed sun gear 55, a central shaft 52 arranged in the sun gear 55 and securely connected with the crown gear 1 at a lower end thereof, several planet pinions 53, and an  
5 actuating shaft 54, which is connected to a movable arm 44 of the pipe bender, and arranged in the sun gear 55. The sun gear 55 has gear teeth on an inner side thereof. The planet pinions 53 are rotary on respective shafts 531 supported in position on the actuating shaft 54, and are engaged with both the central shaft 52 and the toothed inner side of the  
10 sun gear 55. Furthermore, the crown gear 1 is engaged with the actuating pinion 2.

Therefore, when the motor 322 functions, the planet pinions 53 will make circular motion, and the actuating shaft 54 will turn. Consequently, the movable arm 44 is angularly displaced relative to a stationary arm of  
15 the pipe bender to bend a pipe, which has been clipped onto both the movable arm and the stationary arm by means of clipping elements (not shown). Because the planetary gear sets 5 and 32 (gear reduction mechanism) are used in the transmission instead of chain wheels and chains, and because both the power source 3 and the transmission are  
20 disposed in the front holding portion 42 of the pipe bender, the pipe bender occupies less space while sufficient torque output is maintained. And, one can make use of empty space under the front holding portion 42 since there is no part of the actuating mechanism sticking out from or

hung under the front holding portion 42.

In addition, the transmission of the present pipe bender doesn't need adjustment in position of the parts thereof after certain length of time of use because the crown gear 1 is directly engaged with the pinion 2 for  
5 passing on rotation of the output shaft 31 of the power source 3 to the planetary gear set 5. Therefore, the present pipe bender is more convenient to use than the conventional ones.

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